

REMARKS/ARGUMENTS

The Non-Final Office Action dated June 10, 2011 ("Office Action"), has been received and carefully considered. In this response, claims 1 and 22 have been amended. No new matter has been added. Entry of the amendments to claim 1 and addition of claim 22 is respectfully requested. Reconsideration of the outstanding rejections in the present application is also respectfully requested based on the following remarks.¹

I. THE EXAMINER INTERVIEW

At the outset, the undersigned thanks the Examiner for the courtesies extended during the interview conducted on September 27, 2011.

II. THE OBJECTION OF CLAIMS 1 AND 22

On page 2 of the Office Action, claims 1 and 22 were objected to because of minor informalities. The objection of claims 1 and 22 has been rendered moot in view of the current amendments. Thus, Applicant respectfully requests the withdrawal of the objection of claims 1 and 22.

III. THE INDEFINITENESS REJECTION OF CLAIMS 1-9 AND 21

On page 3 of the Office Action, claims 1-9, 21, and 22 were rejected under 35 U.S.C. § 112, second paragraph, as being allegedly indefinite for failing to particularly point out and distinctly claim the invention. This rejection is respectfully traversed.

¹ As Applicant's remarks with respect to the Examiner's rejections are sufficient to overcome these rejections, Applicant's silence as to assertions made by the Examiner in the Office Action or certain requirements that may be applicable to such rejections (e.g., assertions regarding dependent claims, whether a reference constitutes prior art, whether references are legally combinable for obviousness purposes) is not a concession by Applicant that such assertions are accurate or such requirements have been met, and Applicant reserves the right to analyze and dispute such in the future.

Regarding claim 1, the Office Action asserts that the limitation “conditioning and pre-melting” is indefinite for failing to particularly point out and distinctly claim the invention. Applicant respectfully disagrees. Applicants submit that the Specification defines the processed semiconductor wafer as a wafer having electrically active structures thereon. *See, e.g.*, Published Application, paragraph [0016], lines 6-7.

The opinion of the examiner that there are multiple possibilities to which “conditioning” may refer to, as indicated on page 5 of the Office Action is respectfully traversed. In particular, Applicants respectfully submit that the alleged possibilities (1) is not possible because the glass paste is formed into a specific shape in a specific location during the step of applying the glass paste to the respective surfaces; (2) is also not possible because mixing glass frit with a solvent to form the glass paste, has to be done, according to claim 1, **prior to applying** the glass paste to the respective surfaces; (3) is further not possible because stirring of the glass paste, if necessary, would have to be done prior to providing the glass paste as claimed in amended claim 1. In other words, a finished glass paste is provided, the finished glass paste is applied to the respective surfaces and only thereafter, the conditioning and pre-melting takes place.

Further, the sequence of the steps in amended claim 1 can also be taken from the “FERRO” reference because the page 2 of this reference, clearly shows the sequence that:

- (1) *The constituencies of the glass paste are mixed completely,*
- (2) *a layer of the glass paste is printed on a substrate,*
- (3) *the base film is dried (conditioned) at approximately 110°C for a period of time, and*
- (4) *the binder resin is burned out (pre-melted) at approximately 350°C*
- (5) *a sealing cycle is carried out which completes the sealing operation.*

Thus, in view of the above, a man skilled in the art would clearly understand that conditioning and pre-melting is carried out prior to finally bonding the wafers and between applying the glass

paste to a substrate and completing the device by bonding the wafers through the glass pastes using mechanical pressure. The conditioning and pre-melting is carried out to preliminarily prepare the wafers in order to remove the binder, and this removal of the binder can only happen in between applying the glass paste to the substrate and finally baking the glass paste to form the seal. Therefore, a man skilled in the art would not have any other interpretation at hand but that the "conditioning and pre-melting" is synonymous to drying and pre-baking which is done prior to finally baking the glass material to form the seal out of glass.

Also, the geometrical alignment of the at least two processed semiconductor wafers takes place after the conditioning and pre-melting the electrically non-conducting glass paste and the electrically conducting pastes. Thus, one skilled in the art would be informed and understands that the conditioning and pre-melting is a preparatory measure "to put the wafers into a proper state for work" (Merriam Webster Dictionary) to be able to attach the wafers to each other. Without the conditioning and pre-melting step, the wafers may not be joined by pressure under appropriate processing temperatures because the glass paste would not remain at the appropriate locations on the wafers but "smear out" during the alignment process and the solvent contained in the paste would disturb the bonding process by evaporation. Thus, it is apparent to one skilled in the art that "conditioning and pre-melting" cannot be associated with measures which are taken before applying the glass paste to the wafers, but only such steps are concerned to prepare the glass paste for the subsequent bonding.

In the Response to Argument section of the Office Action, the Office alleges that there are multiple terms for glass bonding. However, in any instance where a glass paste is recited, there is a mixture of glass particles and solvent (binder). Also, the Office alleges that FERRO reference is only dealing with one particular type of glass paste and that the information supplied by the Applicant is published after the priority date of the present application. Applicant

respectfully disagrees. In particular, Applicant submits that conditioning is “according to the state of the art” which means that conditioning was used as a technical term in this technical field prior to the priority date of the present application.

Accordingly, Applicant respectfully requests that the aforementioned indefiniteness rejection of claims 1-9, 21 and 22 be withdrawn.

IV. THE OBVIOUSNESS REJECTION OF CLAIMS 1-8, 21 AND 22

On page 8 of the Office Action, claims 1-8, 21 and 22 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over U.S. Patent No. 5,094,969 to Warren (“Warren”) in view of U.S. Patent No. 5,545,912 to Ristic *et al.* (“Ristic”) and further in view of U.S. Patent No. 6,817,917 to Kado *et al.* (“Kado”). This rejection is respectfully traversed.

Under 35 U.S.C. § 103, the Patent Office bears the burden of establishing a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). There are four separate factual inquiries to consider in making an obviousness determination: (1) the scope and content of the prior art; (2) the level of ordinary skill in the field of the invention; (3) the differences between the claimed invention and the prior art; and (4) the existence of any objective evidence, or “secondary considerations,” of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966); *see also KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727 (2007). An “expansive and flexible approach” should be applied when determining obviousness based on a combination of prior art references. *KSR*, 127 S. Ct. at 1739. However, a claimed invention combining multiple known elements is not rendered obvious simply because each element was known independently in the prior art. *Id.* at 1741. Rather, there must still be some “reason that would have prompted” a person of ordinary skill in the art to combine the elements in the specific way that he or she did. *Id.*; *In re Icon Health & Fitness, Inc.*, 496 F.3d 1374, 1380 (Fed. Cir. 2007). Also,

modification of a prior art reference may be obvious only if there exists a reason that would have prompted a person of ordinary skill to make the change. *KSR*, 127 S. Ct. at 1740-41.

Regarding claim 1, the Office Action alleges that Warren, Ristic, and Kado disclose an embodiment of the claimed subject matter. Applicant respectfully disagrees. Applicant submits that neither the cited portions of Warren, Ristic, and Kado, nor Warren, Ristic, and Kado generally, disclose, or even suggest, joining “at least two processed semiconductor wafers having electrically active structures thereon” in a middle position of a stack wafer and “joining the at least two processed semiconductor wafers at a first processing temperature of the electrically non-conducting glass paste and at a second processing temperature of the electrically conducting glass pastes using a mechanical pressure,” as currently recited in claim 1.

Furthermore, claims 1 and 22 claim the following sequence of steps of:

- providing electrically non-conducting glass paste and electrically conducting glass paste;
- applying patterned layers of electrically non-conducting glass paste and electrically conducting glass paste on said wafer sides;
- thereafter conditioning and premelting the electrically non-conducting glass paste and electrically conducting glass pastes;
- thereafter providing geometrical alignment of the at least two processed semiconductor wafers to be connected; and
- thereafter joining the at least two processed semiconductor wafers at a first processing temperature of the electrically non-conducting glass paste and at a second processing temperature of the electrically conducting glass pastes using a mechanical pressure.

Applicants respectfully submit that Warren, Ristic, and Kado, either alone or in combination, fail to disclose, or even suggest, each and every limitation of claim 1. In particular, Warren teaches forming a *substrate* that is formed from a *core substrate* out of flexible, low-temperature, co-fireable ceramic tape and an *outer substrate* of ceramic tape. The core substrate has apertures for *inserting* (complete) integrated circuit devices therein. The substrate is heated to form a *rigid body* which then mounts the integrated circuits (ICs). The rigid body and the ICs are covered or at least partly covered with an insulating glass and heated to a temperature that

fuses the glass to hermetically seal the substrate in a single structure. *See* Warren, abstract. Thus, Warren fails to disclose, or even suggest a process for connecting processed semiconductor wafers where the processed semiconductor wafers **have electrically active structures thereon** which are to be completed to electrical circuits upon bonding of the two processed semiconductor wafers upon having aligned the wafers and firing the glass paste layers.

The abstract of Warren discloses that the substrate consists of ceramic tape and is heated to form a **rigid body** which mounts the ICs. Therefore, Warren is directed to product a rigid body which is rigid enough to withstand subsequent handling in aligning the substrates prepared and to withstand the application of an additional layer of insulating glass paste. *See* Warren, column 3, lines 42-56. Moreover, it would not have been obvious to one of ordinary skilled in the art to transfer the production steps or methods which are possible with rigid substrates to process semiconductor wafers which are much more fragile and thus more susceptible to breakage when applying such production method.

Furthermore, Warren discloses that additional layers of insulating glass paste are to be applied to the substrates, which are applied for the purpose of joining the areas of substrates to each other and therefore need not be restricted to very definite individual areas or portions of the substrate. *See* Warren, column 3, lines 50-56. In contrast, the insulating glass paste pattern of the present application is very accurate and serves two purposes, i.e., (1) to fix the wafers to each other and (2) to complete the electrical circuit with the conductive glass paste areas and to fix the wafers to each other with the insulating glass paste pattern. Therefore, Warren discloses that the function of insulating the electrical circuitry and the function of joining the substrates are carried out by separate means while the two functions are achieved by one and the glass paste patterns in the present application and are prefabricated prior to the alignment and bonding of the wafers. In addition, Warren fails to disclose or even suggest the claimed sequence of steps.

The Office acknowledges that the substrate of Warren is not a wafer and relies on Ristic to remedy the deficiencies of Warren. However, Ristic discloses that the wafers are, at first, mechanically processed and thereafter bonded in an electrically insulating way by means of layer 14. The cover 16 mentioned in Ristic has only the function of electrically shielding the circuitry on substrate 12. The cover 16 of Ristic cannot be understood as a processed wafer. Therefore, completion of an electric circuitry being designed partly on each of the two wafers which are combined according to an embodiment of the present disclosure, is not possible in Ristic. Thus, the combination of Warren and Ristic fails to disclose, or even suggest, the claimed invention.

Further, the Office Action asserts that Kado discloses pre-baking of glass paste at 350°C. However, pre-baking is only one of the sequence of steps taken according to claim 1 directed to prepare two wafers, cover them with electrically conductive and electrically nonconductive layers in particular patterns and joining the two wafers with their respective layers in a final processing step which not only joins the two wafers by bonding but also completes the electrical circuitry contained on the two processed wafers. Kado, at most, discloses pre-baking or pre-melting glass paste, and fails to disclose the sequences of steps for bonding the two wafers together, i.e., using the pre-melted glass paste pattern as it is pre-melted for bonding the wafers together after alignment thereof. Thus, Applicants respectfully submit that the combination of Warren, Ristic, and Kado, either alone or in combination, fail to disclose, or even suggest, each and every claimed limitation recited in claim 1.

Even assuming, for the sake of argument, that Warren, Ristic and Kado teach all the claimed elements, the Office does not present a proper rationale to combine the references to achieve the claimed system and method, and thus has failed to set forth a prima facie case of obviousness. Specifically, modifying the primary reference to include the features of the secondary reference would not have been obvious because the modification would represent

classic impermissible hindsight. Merely restating the features of the references does not support a rationale of obviousness. Such statements are clearly improper and based on hindsight gleaned from Applicants' own disclosure.

Under 35 U.S.C. § 103, the USPTO bears the burden of establishing a prima facie case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). An “expansive and flexible approach” should be applied when determining obviousness based on a combination of prior art references. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007). However, a claimed invention combining multiple known elements is not rendered obvious simply because each element was known independently in the prior art. *Id.* at 1741. Rather, there must still be some “reason that would have prompted” a person of ordinary skill in the art to combine the elements in the specific way that he or she did. *Id.* Also, modification of a prior art reference may be obvious only if there exists a reason that would have prompted a person of ordinary skill to make the change. *Id.* at 1740-41. One method to establish a prima facie case of obviousness is to show that the following three criteria are met: (1) there must be some suggestion or motivation to modify the reference or to combine reference teachings, (2) there must be a reasonable expectation of success, and (3) the prior art references must teach or suggest all the claim limitations. See MPEP § § 2143 and 2143.03; citing *In re Vaeck*, 947 F.2d 488, 493 (Fed. Cir. 1991); *In re Royka*, 490 F.2d 1981 (CCPA 1974).

Regarding claims 2-8 and 21, these claims are dependent upon independent claim 1. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988). Thus, since independent claim 1 should be allowable as discussed above, claims 2-8 and 21 should also be allowable at least by virtue of their dependency on independent claim 1. Moreover, these claims recite additional features

which are not disclosed, or even suggested, by the cited references taken either alone or in combination.

Regarding independent claim 22, although of different scope than independent claim 1, this claim includes subject matter similar to those discussed above with respect to independent claim 1. Thus, at least some of the arguments set forth above with respect to independent claim 1 are similarly applicable to independent claim 22. Accordingly, Applicant respectfully submits that independent claim 22 is allowable over Warren, Ristic and Kado for at least the same reasons set forth with respect to independent claim 1.

In view of the foregoing, Applicant respectfully requests that the aforementioned obviousness rejection of claims 1-8, 21 and 22 be withdrawn.

V. THE OBVIOUSNESS REJECTION OF CLAIM 9

On page 22 of the Office Action, claim 9 was rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Warren in view of Ristic further in view of Kado and further in view of U.S. Patent Application Publication No. 2003/0170936 to Christensen ("Christensen"). This rejection is respectfully traversed.

Applicant respectfully submits that the aforementioned obviousness rejection of claim 9 has become moot in view of the deficiencies of the primary references (*i.e.*, Warren, Ristic, and Kado) as discussed above with respect to independent claim 1. That is, claim 9 is dependent upon independent claim 1 and thus inherently incorporates all of the limitations of independent claim 1. Also, the secondary reference (*i.e.*, Christensen) fails to disclose, or even suggest, the deficiencies of the primary references as discussed above with respect to independent claim 1. Indeed, the Office Action does not assert such. Thus, the combination of the secondary reference with the primary references also fails to disclose, or even suggest, the deficiencies of the primary

references as discussed above with respect to independent claim 1. Accordingly, claim 9 should be allowable over the combination of the secondary reference with the primary references at least by virtue of its dependency on independent claim 1. Moreover, claim 9 recites additional features which are not disclosed, or even suggested, by the cited references taken either alone or in combination.

In view of the foregoing, Applicant respectfully requests that the aforementioned obviousness rejection of claim 9 be withdrawn.

VI. CONCLUSION

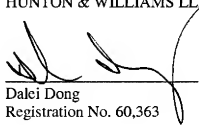
In view of the foregoing amendments and arguments, Applicant respectfully submits that this application is now in condition for allowance. If the Examiner believes that prosecution and allowance of the application will be expedited through an interview, whether personal or telephonic, the Examiner is invited to telephone the undersigned with any suggestions leading to the favorable disposition of the application.

It is believed that no fees are due for filing this Response. However, the Director is hereby authorized to treat any current or future reply, requiring a petition for an extension of time for its timely submission as incorporating a petition for extension of time for the appropriate length of time. Applicant also authorizes the Director to charge all required fees, fees under 37 C.F.R. §1.17, or all required extension of time fees, to the undersigned's Deposit Account No. 50-0206.

Respectfully submitted,

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